



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/632,111	08/01/2003	Omur M. Sezerman	Sezerman	3481

23294 7590 02/22/2005

JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

EXAMINER

BOUTSIKARIS, LEONIDAS

ART UNIT	PAPER NUMBER
----------	--------------

2872

DATE MAILED: 02/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/632,111

Applicant(s)

SEZERMAN ET AL.

Examiner

Leo Boutsikaris

Art Unit

2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-58 is/are pending in the application.
- 4a) Of the above claim(s) 37-52 and 55 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-36, 53, 54 and 58 is/are rejected.
- 7) ☒ Claim(s) 56 and 57 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3/31/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Applicant's election of Species I in the reply filed on 1/31/2005 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Species I includes claims 1-36, 53-54 and 56-58. Claims 37-52, 55 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Species, there being no allowable generic or linking claim.

Furthermore, the Examiner agrees with Applicant that claim 37 is generic to Species II, III and IV.

Priority

Acknowledgment is made of applicant's claim for foreign priority based on an application No. 2,396,831 filed in Canada on 8/2/2002. It is noted, however, that applicant has not filed a certified copy of the above application as required by 35 U.S.C. 119(b).

Specification

The abstract of the disclosure is objected to because it contains more than 150 words. Correction is required. See MPEP § 608.01(b).

Claim Objections

Claims 1-36, 53-54 and 56-58 are objected to because of the following informalities:

Claim 1 recites “at the target regions” in line 14, which lacks antecedent basis.

It appears that the phrase “permanent refractive index changes in said waveguiding device” was inadvertently left out after the word “inducing” in line 2 of claim 2.

Claims 1, 13, 25, lines 3-4, recite “using beam[s] generated by...focused pulsed laser light source[s]”. It is the beams themselves that are focused, not the laser light sources. It is suggested that the above is rephrased as “using focused beam[s] generated by...pulsed laser light source[s]”.

Claim 14, lines 12, 17, recites “said combined focal regions” which lack antecedent basis.

Claims 2-12, 15-24, 26-36, 53-54 and 56-58 inherit the deficiencies of claims 1, 13, 25 from which they depend.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 5, 10, 12, 17, 24-36, 53 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 5, 17, 29 recite the size of the beam diameter of the laser source. First, laser sources do not have beam diameters themselves, and second it is not clear at which point along

Art Unit: 2872

the optical path is the beam diameter measured (e.g. at the beam waist or at the focal region). For examination purposes it will be taken that the claimed size is at the focal region.

Claim 10 recites a limitation, which is narrative in nature, in addition to being very confusing. The Examiner cannot ascertain the meaning of the above claim, and a meaningful prior art search cannot be undertaken.

Claims 12, 24, 36 recite “doped glasses designed for enhanced multiphoton absorption and lower thresholds for femtosecond laser induced material modification” as one example of an optical waveguiding device, which according to the corresponding base claims has at least one core and at least one cladding. A doped glass by itself does not have a core and a cladding, and the above is in contradiction with the invention which refers to creating a zone of permanently altered refractive index in waveguiding devices having a core and a cladding formed therein.

Claim 25 recites a step where two laser beams from two laser sources are combined to create a single laser beam having a focal region (at the waveguiding device). Regarding the use of two separate laser sources, the specification only shows an embodiment where each of the two laser beams creates a focal region in the waveguiding device (Fig. 3). There is no disclosure whatsoever of combining the two laser beams before they are incident on the waveguiding device. For examination purposes it will be assumed that there are two focal regions formed in the waveguiding device, which may be combined to achieve the required amount of beam intensity.

Claim 53 refers to an optical source having characteristic optical mode field properties, and to an interface point between the optical source and a waveguide. The optical source is located away from the waveguide and it is not clear where the interface point might be relative to

Art Unit: 2872

the waveguide. For examination purposes, it will be taken that the interface point is any point proximate to the waveguide in the waveguiding device.

Claims 26-36 inherit the deficiency of claim 25 from which they depend.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 6, 8-9, 11-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Kouta (US 2001/0021293).

Regarding claims 1, 8, Kouta discloses a method for creating a zone of permanently altered refractive index characteristics in an optical waveguiding device made of glass material and having core 12 and surrounding cladding in a substrate 11 (Fig. 1), using a focused laser beam from a pulsed laser source wherein the wavelength is 800 nm (beyond the absorption edge of the glass material which is around 300 nm); the pulse width is 150 femtoseconds (less than 1 picosecond); the pulse energy is 0.1 microjoule; the laser beam having a peak intensity at a defined focal region 15; and wherein the repetition rate of the pulsed laser beam is selected so that the applied heat softens the material and induces permanent refractive index changes in the waveguiding device. ([0042], [0064]-[0073]). It is noted that as the focal region is scanned along the device there is an underlying aligning of the focal region with a defined target region.

Art Unit: 2872

Regarding claim 2, the focal region is oriented perpendicularly relative to the longitudinal axis of the core (see Fig. 1), and Kouta discloses that spectrometric measurements of the waveguide are taken before and after illumination to monitor the refractive index change in the device.

Regarding claim 3, the pulse repetition rate is 200 KHz ([0066]).

Regarding claim 6, the laser beam is focused onto the waveguiding device via the use of a lens 14.

Regarding claim 4, the laser source is based on Ti-sapphire gain material ([0066]).

Regarding claim 9, Kouta discloses that the pulse repetition rate of 200 KHz is selected so that the pulses deliver heat quickly enough to soften the material locally ([0042]-[0045]).

Regarding claim 11, the energy of the pulse is 10^{-7} J, the duration is 150×10^{-15} s, and the area is πr^2 , where $r = 3.5 \times 10^{-4}$ cm. The resulting peak intensity per pulse is 18×10^{13} W/cm².

Regarding claim 12, the waveguiding device where zones of permanent refractive index are written is an optical waveguide embedded in a glass substrate (Fig. 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Borelli (US 2003/0099452).

Regarding claims 5, 7, Kouta discloses all the limitations of the above claim except for specifying the focal length and the numerical aperture of the lens 14 as well as size of the beam spot at the focal point. Borelli discloses a method of creating waveguides in glass substrates by focusing femtosecond laser pulses on the substrates (Fig. 1), wherein it is disclosed that the objective lens 12 used to focus the light has a focal length of 20 mm and a NA of 0.28 ([0056]). The resulting beam spot has dimensions 1.3 microns by 2.3 microns. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a focusing lens in the system of Kouta with the characteristics of the lens disclosed in the system of Borelli, for achieving a high optical intensity inside the target material, so that enough heat is accumulated locally to create a permanent refractive index change.

Claims 13-16, 18, 20-28, 30, 32-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Dugan (US 2002/0085824).

Kouta discloses all the limitations of the above claims except for teaching that two separate focused laser beams are combined to increase the heat locally in the waveguiding device, thereby creating a permanent refractive index change. Dugan discloses a method of writing refractive index profiles in materials using femtosecond laser pulses (Fig. 1), wherein it is taught that multiple scans overlapping each other within the waveguide can result in a larger induced change in the refractive index ([0016]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine two separate laser pulses inside the waveguide of Kouta, for creating increased heat effects locally, without increasing the intensity of the laser sources.

Art Unit: 2872

Regarding claims 20, 32, Kouta in view of Dugan does not disclose the use of reflective optics to focus the pulsed laser beam. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use reflective focusing optics instead of a refractive lens, since Official Notice is taken that reflective optics is one widely used means for focusing light, having the advantage of lacking the various aberration effects of refractive lenses.

Claims 17, 19, 29, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Borelli (US 2003/0099452) and further in view of Dugan (US 2002/0085824).

Kouta in view of Borelli discloses all the limitations of the above claims except for teaching that two separate focused laser beams are combined to increase the heat locally in the waveguiding device, thereby creating a permanent refractive index change. Dugan discloses a method of writing refractive index profiles in materials using femtosecond laser pulses (Fig. 1), wherein it is taught that multiple scans overlapping each other within the waveguide can result in a larger induced change in the refractive index ([0016]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine two separate laser pulses inside the waveguide of Kouta, for creating increased heat effects locally, without increasing the intensity of the laser sources.

Claims 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Dugan (US 6,768,850).

Kouta discloses all the limitations of the above claims except for teaching that the focused short laser pulses are used to modify the refractive index properties of waveguiding devices so that there is improved coupling between neighboring waveguides or between a

Art Unit: 2872

waveguide and an optical source. Dugan discloses a method of modifying locally the refractive index of a waveguide by using short laser pulses. Dugan further teaches that a region between two adjacent waveguides can be exposed to the short laser pulses, so that its refractive index profile is changed in such a way that there is improved coupling between the two waveguides (Fig. 10, line 31, col. 13 to line 22, col. 14).

Claim 58 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Schaffer (US 2002/0162360).

Kouta discloses all the limitations of the above claim except for teaching that there is an index matching fluid between the laser source and the waveguiding device, so that the optical beam passes through the fluid prior to reaching the target region. Schaffer discloses a method for creating locally heated regions in photonic materials wherein the objective lens used to focus the light is immersed in oil ([0049]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an index matching fluid between the lens and the target region, as taught by Schaffer, for avoiding undesired Fresnel reflections between the various interfaces.

Allowable Subject Matter

Claims 56-57 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 56-57 are allowable over the prior art of record for at least the reason that even though the prior art discloses creation of permanent refractive index regions in photonic

Art Unit: 2872

materials via the use of ultrashort laser pulses, the prior art fails to teach or reasonably suggest a method of creating a zone of permanently altered refractive index characteristics in an optical waveguiding device made of glass including the step of initially applying mechanical stress or an electric field to the waveguiding device and then removing the mechanical stress or the electric field once the zone has been created, as set forth by the claimed combination.

Miura (US 6,154,593) and Dunn (US 6,853,785) disclose methods for modifying the refractive index in glass substrates using femtosecond long focused laser pulses.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Leo Boutsikaris whose telephone number is 571-272-2308.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Leo Boutsikaris, Ph.D.
Primary Patent Examiner, AU 2872
January 16, 2005



LEONIDAS BOUTSIKARIS
PRIMARY EXAMINER